

WHAT IS CLAIMED IS:

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1. A method of reducing a size of a binary image, comprising the steps of:

reducing the size of the binary image in a sub-scanning direction by using a conditional OR process; and

limiting a size-change point determined by a reduction rate to an odd-number line or an even-number line.

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2. The method of reducing the size of a binary image as claimed in claim 1, further comprising the step of thinning out an image of either a line immediately preceding or a line immediately following the size-change point.

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3. A method of reducing a size of a binary image, wherein a reduction process in a sub-scanning direction comprises the steps of:

5 thinning out an image of an odd-numbered line and producing a reduced image using a conditional OR process for an even-number line immediately following the odd-number line when a size-change point determined by a reduction rate is the odd-number line,

10 producing a reduced image using a conditional OR process for an even-number line and thinning out an image of an odd-number line immediately following the even-number line when the size-change point determined by the reduction rate is the even-number line.

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4. The method of reducing the size of a binary image as claimed in claim 3, wherein the method produces but does not output the reduced image and instead outputs a non-reduced image for the even-number line.

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5. The method of reducing the size of a binary image as claimed in claim 3, wherein the method produces and outputs the reduced image when the size-change point determined by the reduction rate is the even-number line.

6. The method of reducing the size of a binary image as claimed in claim 3, wherein the method produces but does not output a reduced image and instead outputs a non-reduced image for the even-number line when the immediately preceding odd-number line is not thinned out.

7. The method of reducing the size of a binary image as claimed in claim 3, wherein the method produces and outputs a reduced image for the even-number line when the immediately preceding odd-number line is thinned out.

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8. A method of reducing a size of a binary image, wherein a reduction process in a sub-scanning direction comprises the steps of:

5 thinning out an image of an even-numbered line and producing a reduced image using a conditional OR process for an odd-number line immediately following the even-number line when a size-change point determined by a reduction rate is the even-number line,

10 producing a reduced image using a conditional OR process for an odd-number line and thinning out an image of an even-number line immediately following the odd-number line when the size-change point determined by the reduction rate is the odd-number line.

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9. The method of reducing the size of a binary image as claimed in claim 8, wherein the method  
20 produces but does not output a reduced image and instead outputs a non-reduced image for the odd-number line.

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10. The method of reducing the size of a binary image as claimed in claim 8, wherein the method produces and outputs a reduced image for the odd-number line.

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11. The method of reducing the size of a binary image as claimed in claim 8, wherein the method produces but does not output a reduced image and instead outputs a non-reduced image for the odd-number line when the immediately preceding even-number line is not thinned out.

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12. The method of reducing the size of a binary image as claimed in claim 8, wherein the method produces and outputs a reduced image for the odd-numbered line when the immediately preceding even-number line is thinned out.

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13. The method of reducing the size of a binary image as claimed in claim 1, wherein the size of the binary image in a scanning direction is reduced before the size of the binary image in the sub-scanning direction is reduced.

10 14. The method of reducing the size of a binary image as claimed in claim 1, wherein, when a target reduction rate is 50 percent or below, a binary image of the target reduction rate is produced by reducing the size of the binary image in the sub-  
15 scanning direction to twice the target reduction rate using a simple thinning-out method and further reducing the reduced binary image to the target reduction rate using the conditional OR process.

15. An image processing device for processing  
20 a binary image comprising:

an image size reduction component that reduces the size of the binary image in a sub-scanning direction by using a conditional OR process; and

a limiting component that limits a size-change  
25 point determined by a reduction rate to an odd-number

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line or an even-number line.

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16. The image processing device as claimed in claim 15, further comprising a component that thins out an image of either a line immediately preceding or a line immediately following the size-change point.

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17. An image processing device for processing  
15 a binary image comprising:

a first component that thins out an image of an odd-numbered line and produces a reduced image using a conditional OR process for an even-number line immediately following the odd-number line when a size-  
20 change point determined by a reduction rate is the odd-number line; and

a second component that produces a reduced image using a conditional OR process for an even-number line and thins out an image of an odd-number line  
25 immediately following the even-number line when the

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size-change point determined by the reduction rate is the even-number line.

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18. The image processing device for processing a binary image as claimed in claim 17, wherein the device produces but does not output a reduced image and instead outputs a non-reduced image for the even-number line.

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19. The image processing device for processing a binary image as claimed in claim 17, wherein the device produces and outputs the reduced image for the even-number line.

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20. The image processing device for processing a binary image as claimed in claim 17, wherein the

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a first component that thins out an image of an even-numbered line and produces a reduced image using a conditional OR process for an odd-number line immediately following the even-number line when a size-change point determined by a reduction rate is the even-number line; and

a second component that produces a reduced image using a conditional OR process for an odd-number line and thins out an image of an even-number line immediately following the odd-number line when the size-  
5 change point determined by the reduction rate is the odd-number line.

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23. The image processing device for processing a binary image as claimed in claim 22, wherein the device produces but does not output a reduced image and instead outputs a non-reduced image for the odd-number  
15 line.

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24. The image processing device for processing a binary image as claimed in claim 22, wherein the device produces and outputs a reduced image for the odd-number line.

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25. The image processing device for processing  
a binary image as claimed in claim 22, wherein the  
device produces but does not output a reduced image and  
instead outputs a non-reduced image for the odd-number  
5 line when the immediately preceding even-number line is  
not thinned out.

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26. The image processing device for processing  
a binary image as claimed in claim 22, wherein the  
device produces and outputs a reduced image for the odd-  
number line when the immediately preceding even-number  
15 line is thinned out.

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27. The image processing device as claimed in  
claim 15, wherein the image size reduction component  
reduces the size of the binary image in a scanning  
direction before reducing the size of the binary image  
in the sub-scanning direction.

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28. The image processing device as claimed in  
claim 15, wherein the image size reduction component,  
when a target reduction rate is 50 percent or below,  
produces a binary image of the target reduction by  
5 reducing the size of the binary image in the sub-  
scanning direction using a simple thinning-out method to  
twice the target reduction rate and further reduces the  
reduced binary image to the target reduction rate using  
the conditional OR process.

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29. The image processing device as claimed in  
15 claim 15, wherein the image size reduction component,  
when a current process line is other than the size-  
change point, reads and then discards data of an  
immediately preceding line memory component, and  
rewrites data read from a memory component in which a  
20 preceding reduction result is stored to the preceding  
line memory component.

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30. An image processing device for processing  
a binary image comprising:

a conditional OR processing component that  
reduces a size of an image in a sub-scanning direction  
5 using a conditional OR process;

a reduction result line memory component that  
stores data output from the conditional OR processing  
component;

an immediately preceding line memory component  
10 that stores binary image data of an immediately  
preceding line; and

a control component that inputs binary image  
data of a current processing line, preceding reduction  
result data read from the reduction result line memory  
15 component, and binary image data of an immediately  
preceding line read from the immediately preceding line  
memory component to the conditional OR processing  
component so as to perform conditional OR processing of  
the current processing line, and limits a size-change  
20 point determined by a reduction rate and employing the  
data output from the conditional OR processing component  
to either an odd-number line or an even-number line.

31. The image processing device as claimed in claim 30, wherein the control component further thins out an image of either a line immediately preceding or a line immediately following the odd-number line or the even-number line corresponding to the size-change point.

10 32. An image processing device for processing a binary image comprising:

a conditional OR processing component that reduces a size of an image in a sub-scanning direction using a conditional OR process;

15 a reduction result line memory component that stores data output from the conditional OR processing component;

an immediately preceding line memory component that stores binary image data of an immediately preceding line; and

20 a control component that inputs binary image data of a current processing line, preceding reduction result data read from the reduction result line memory component, and binary image data of an immediately preceding line read from the immediately preceding line

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memory component to the conditional OR processing component so as to perform conditional OR processing of the current processing line, wherein:

when a size-change point determined by a  
5 reduction rate is an odd-number line, the control component thins out an image of the odd-number line and reduction data is produced by the conditional OR processing component for an even-number line immediately succeeding the odd-number line; and

10 when the size-change point determined by the reduction rate is an even-number line, reduction data is produced by conditional OR processing component for the even-number line and thins out an image of an odd-number line immediately succeeding the even-number line.

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20 33. The image processing device for processing a binary image as claimed in claim 32, wherein the device does not output the produced reduction data and instead outputs non-reduction data for the even-number line.

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34. The image processing device for processing a binary image as claimed in claim 32, wherein the device produces and outputs the reduced image for the even-number line.

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35. The image processing device for processing a binary image as claimed in claim 32, wherein the device produces but does not output a reduced image and instead outputs a non-reduced image for the even-number line when the immediately preceding odd-number line is not thinned out.

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36. The image processing device for processing a binary image as claimed in claim 32, wherein the method produces and outputs a reduced image for the even-number line when the immediately preceding odd-number line is thinned out.

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37. An image processing device for processing  
a binary image comprising:

a conditional OR processing component that  
reduces a size of an image in a sub-scanning direction  
5 using a conditional OR process;

a reduction result line memory component that  
stores data output from the conditional OR processing  
component;

an immediately preceding line memory component  
10 that stores binary image data of an immediately  
preceding line; and

a control component that inputs binary image  
data of a current processing line, preceding reduction  
result data read from the reduction result line memory  
15 component, and binary image data of an immediately  
preceding line read from the immediately preceding line  
memory component to the conditional OR processing  
component so as to perform conditional OR processing of  
the current processing line, wherein:

20 when a size-change point determined by a  
reduction rate is an even-number line, the control  
component thins out an image of the even-number line and  
produces reduction data by the conditional OR processing  
component for an odd-number line immediately succeeding  
25 the even-number line; and

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when the size-change point determined by the  
reduction rate is an odd-number line, the control  
component produces reduction data output by the  
conditional OR processing component for the odd-number  
5 line and thins out an image of an even-number line  
immediately succeeding the odd-number line.

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38. The image processing device for processing  
a binary image as claimed in claim 37, wherein the  
device produces but does not output the reduced image  
and instead outputs a non-reduced image for the odd-  
15 number line.

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39. The image processing device for processing  
a binary image as claimed in claim 37, wherein the  
method produces and outputs a reduced image for the odd-  
number line.

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40. The image processing device for processing  
a binary image as claimed in claim 37, wherein the  
method produces but does not output a reduced image and  
instead outputs a non-reduced image for the odd-number  
5 line when the immediately preceding even-number line is  
not thinned out.

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41. The image processing device for processing  
a binary image as claimed in claim 37, wherein the  
method produces and outputs a reduced image for the odd-  
number line when the immediately preceding even-number  
15 line is thinned out.

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42. The image processing device as claimed in  
claim 30, wherein the control component reduces the size  
of the binary image in a scanning direction before  
reducing the size of the binary image in the sub-  
scanning direction.

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43. The image processing device as claimed in claim 30, wherein the control component, when a target reduction rate is 50 percent or below, produces a binary image of the target reduction rate by reducing the size of the binary image in the sub-scanning direction to twice the target reduction rate using a simple thinning-out method and further reducing the reduced binary image to the target reduction rate using the conditional OR process.

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44. A method of controlling an image processing device for processing a binary image, the method comprising the steps of:

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reducing a size of an image in a sub-scanning direction using a conditional OR process conducted by a conditional OR processing component;

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storing data output from the conditional OR processing component in a reduction result line memory component;

storing binary image data of an immediately preceding line in an immediately preceding line memory

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component;

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inputting binary image data of a current  
processing line, preceding reduction result data read  
from the reduction result line memory component, and  
binary image data of an immediately preceding line read  
5 from the immediately preceding line memory component to  
the conditional OR processing component so as to perform  
conditional OR processing of the current processing  
line; and

limiting a size-change point determined by a  
10 reduction rate and employing the data output from the  
conditional OR processing component to either an odd-  
number line or an even-number line.

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45. The method of controlling an image  
processing device for processing a binary image as  
claimed in claim 44, further comprising the step of

20 thinning out an image of either a line  
immediately preceding or a line immediately following  
the odd-number line or the even-number line  
corresponding to the size-change point.

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46. A method of controlling an image processing device for processing a binary image, the method comprising the steps of:

reducing a size of an image in a sub-scanning  
5 direction using a conditional OR process conducted by a conditional OR processing component;

storing data output from the conditional OR processing component in a reduction result line memory component;

10 storing binary image data of an immediately preceding line in an immediately preceding line memory component;

inputting binary image data of a current processing line, preceding reduction result data read  
15 from the reduction result line memory component, and binary image data of an immediately preceding line read from the immediately preceding line memory component to the conditional OR processing component so as to perform conditional OR processing of the current processing  
20 line;

thinning out an image of an odd-number line and causing reduction data to be produced by the conditional OR processing component for an even-number line immediately succeeding the odd-number line when a  
25 size-change point determined by a reduction rate is the

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odd-number line; and

causing reduction data produced by the  
conditional OR processing component for an even-number  
line and thinning out an image of an odd-number line  
5 immediately succeeding the even-number line when the  
size-change point determined by the reduction rate is  
the even-number line.

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47. The method of controlling an image  
processing device for processing a binary image as  
claimed in claim 46, wherein the step of producing a  
15 reduced image using the conditional OR process produces  
but does not output the reduced image and instead  
outputs a non-reduced image for the even-number line.

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48. The method of controlling an image  
processing device for processing a binary image as  
claimed in claim 46, wherein the step of producing a  
25 reduced image using the conditional OR process produces

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and outputs the reduced image for the even-number line.

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49. The method of controlling an image processing device for processing a binary image as claimed in claim 46, wherein the step of producing a reduced image using the conditional OR process method produces but does not output a reduced image and instead outputs a non-reduced image for the even-number line when the immediately preceding odd-number line is not thinned out.

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50. The method of controlling an image processing device for processing a binary image as claimed in claim 46, wherein the step of producing a reduced image using the conditional OR process method produces and outputs a reduced image for the even-number line when the immediately preceding odd-number line is thinned out.

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51. A method of controlling an image processing device for processing a binary image, the method comprising the steps of:

reducing a size of an image in a sub-scanning  
5 direction using a conditional OR process conducted by a conditional OR processing component;

storing data output from the conditional OR processing component in a reduction result line memory component;

10 storing binary image data of an immediately preceding line in an immediately preceding line memory component;

inputting binary image data of a current processing line, preceding reduction result data read  
15 from the reduction result line memory component, and binary image data of an immediately preceding line read from the immediately preceding line memory component to the conditional OR processing component so as to perform conditional OR processing of the current processing  
20 line;

thinning out an image of an even-number line and causing reduction data to be produced by the conditional OR processing component for an odd-number line immediately succeeding the even-number line when a  
25 size-change point determined by a reduction rate is the

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even-number line; and

causing reduction data produced by the  
conditional OR processing component for an odd-number  
line and thinning out an image of an even-number line  
5 immediately succeeding the odd-number line when the  
size-change point determined by the reduction rate is  
the odd-number line.

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52. The method of controlling an image  
processing device for processing a binary image as  
claimed in claim 51, wherein the method produces but  
15 does not output a reduced image for the odd-number line.

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53. The method of controlling an image  
processing device for processing a binary image as  
claimed in claim 51, wherein the method produces and  
outputs a reduced image for the odd-number line.

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54. The method of controlling an image processing device for processing a binary image as claimed in claim 51, wherein the method produces but does not output a reduced image and instead outputs a non-reduced image for the odd-number line when the immediately preceding even-number line is not thinned out.

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55. The method of controlling an image processing device for processing a binary image as claimed in claim 51, wherein the method produces and outputs a reduced image for the odd-number when the immediately preceding even-number line is thinned out.

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56. The method of controlling an image processing device for processing a binary image as claimed in claim 44, wherein the size of the binary image in a scanning direction is reduced before the size of the binary image in the sub-scanning direction is

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reduced.

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57. The method of controlling an image  
processing device for processing a binary image as  
claimed in claim 44, wherein, when a target reduction  
rate is 50 percent or below, a binary image of the  
10 target reduction rate is produced by reducing the size  
of the binary image in the sub-scanning direction to  
twice the target reduction rate using a simple thinning-  
out method and further reducing the reduced binary image  
to the target reduction rate using the conditional OR  
15 process.

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